CIS 568-01: Data Visualization (2024 Fall)

FINAL PROJECT DOCUMENTATION

SUBMITION DATE:

TITLE

SATELLITES ORBITING THE EARTH'S SURFACE

GROUP-12

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DATASET

We took our data set from UCS Satellite Database, which has In-depth details on the 6,718 satellites currently orbiting Earth, including their country of origin, purpose, and other operational details. Assembled by experts at the Union of Concerned Scientists (UCS), the Satellite Database is a listing of the more than 6,718 operational satellites currently in orbit around Earth.

SECTON I

1. Overview: Users can gain an overview of all operational satellites currently orbiting the Earth. The visualization likely provides a comprehensive display of satellite positions and key details.

2. Identify Specific Satellites: Users can identify and gather information about specific satellites by interacting with the visualization. This could involve clicking on or hovering over individual satellites to reveal details such as mass, power, launch date, expected lifetime, and orbital characteristics.

3. Compare Satellite Attributes: The visualization allows users to compare various attributes among satellites. Users may be able to visually compare factors like mass, power, launch date, or orbital parameters to identify patterns or trends.

4. Filter Satellites: Users can filter satellites based on specific criteria. This could include filtering by satellite purpose, ownership, or technical specifications, enabling a more focused analysis.

5. Explore Orbital Characteristics: Users can explore the orbital characteristics of satellites, including apogee, perigee, inclination, and period. This allows for a deeper understanding of the distribution and diversity of satellite orbits.

6. Understand Ownership and Usage: The visualization likely provides insights into who owns, operates, and built each satellite. Users can explore this information to understand the global landscape of satellite ownership and usage.

PRINCIPLES USED

Data-Ink Ratio (Tufte's Principle):

The JSON structure is designed with conciseness in mind, featuring a well-defined hierarchy that minimizes redundant information. Each element contributes directly to comprehending the diverse types and subtypes of satellites.

Multiview and Faceting (Munzner's Techniques):

The inherent structure serves as a form of faceting by categorizing satellites into types (e.g., Communications, Earth Observation) and subcategories (e.g., Equatorial, Elliptical). This facilitates a multiview approach, allowing users to analyze satellites based on their intended purposes.

Filtering (Munzner's Technique):

The hierarchical arrangement enables effective filtering based on different criteria. Users can focus on specific satellite types or drill down to subtypes, such as exploring Equatorial satellites within the Communications category, enhancing the granularity of analysis.

Hierarchy and Nesting (Both Principles):

The hierarchical structure contributes to clarity and understanding, illustrating the relationships between various satellite types and their subtypes. This adherence to hierarchy aligns with principles advocated by both Tufte and Munzner.

Color and Encodings (Both Principles):

While the JSON doesn't explicitly include color, in a visualization implementation, color could be leveraged to distinguish between satellite types or emphasize specific attributes. This aligns with the principles of employing color effectively to enhance visual comprehension.

Detail and Context (Both Principles):

The structure strikes a balance between detail and context by categorizing satellites into types and subtypes. This approach enables users to delve into specific types for detailed information while maintaining an overarching understanding of the broader satellite categories.

Interaction (Both Principles):

In the visualization implementation using D3.js, the structure could facilitate interactive features. Users might engage with the data by clicking or hovering over nodes to reveal additional details about each satellite type or subtype, enhancing the user experience.

SECTION II

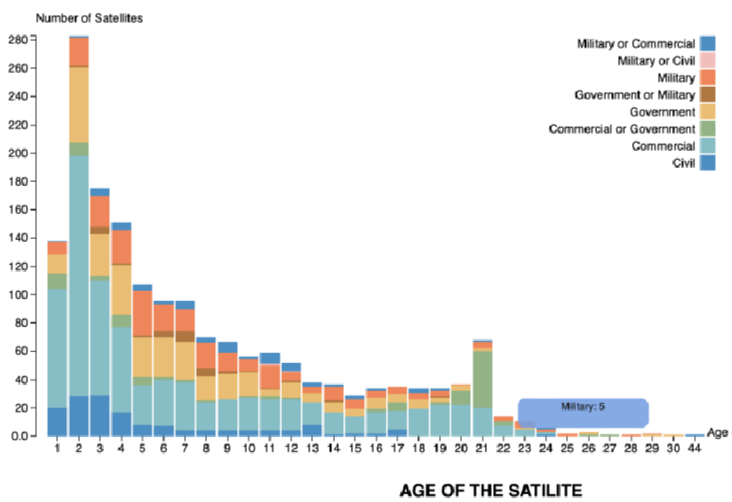
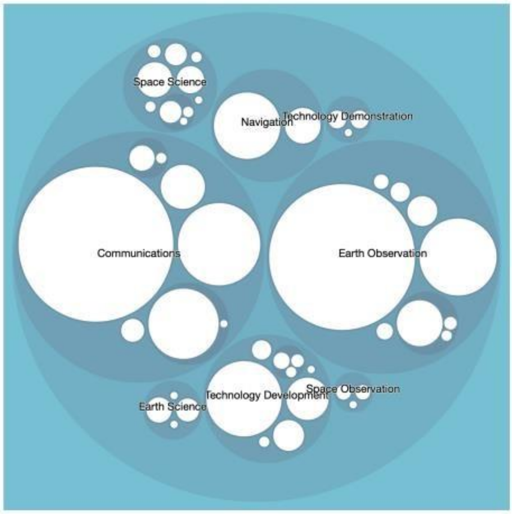


FIG: 1 AGE OF THE SATELLITES

The stacked bar chart illustrates the distribution of satellite ages categorized by their respective functionalities. The visualization effectively portrays the correlation between the number of satellites and their specific ages, concurrently showcasing their associated functionalities.

It can be seen from visual that oldest functioning satellite that is still orbiting the Earth was launched 44 years ago for mix use of Military and Commercial purpose.



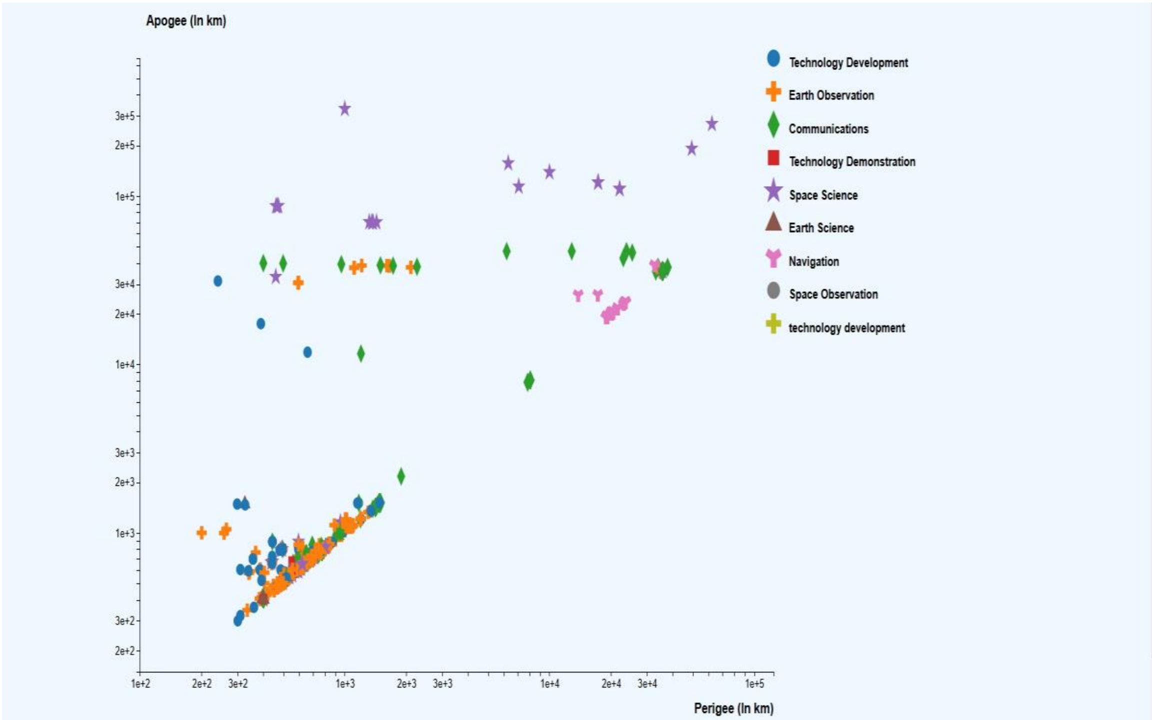
PURPOSE OF THE SATELLITE

FIG: 2 ORBITS OF THE SATELLITES

The concentric circles are packed with information related to the satellite in every layer.

We can observe the division of the satellite in the initial view, but when we move to the second layer, we can observe type of orbit the satellite revolves around the earth.

In the next layer we can see the orbit class of the satellites like LEO, MEO, GEO etc.



SATELLITES VIEW

In this vinal visualization, we use the scatter plot to plot the apogee and perigee of the satellites and separated based on their purpose.

Every unique symbol represents a unique purpose of the satellite.

When hovered to a particular satellite one can understand the purpose along with the exact apogee and perigee of individual satellites.

SECTION III

Goals achieved:

We have successfully implemented the concentric circle visualization which is lacking in phase 1 and phase 2.

In addition to that we additionally added the user interaction to visualization 1 which we did not planned on doing.

Obstacles:

Finding the styles to our visualization is the major obstacle.

Along with that we also faced problems while choosing the type of visualizations we need to use in order to get the best out of the data and express an exceptional story.

Limitations:

Our project only tells a small part of the story as we used 3 visualizations.

Separating the data is not up to the mark as the data still need to be filter a lot.

Future work:

1. We can add more features and more visualizations as the dataset have a lot of columns.
2. Enhance the user interface and make it even more user friendly.
3. Deploy a real-world application to monitor the satellites in live.